Zooarchaeology and taphonomy of FLK North 5

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Abstract:

The assemblage from Level 5 of the FLK North locality is particularly interesting because unlike many Bed I sites (except FLK North North Level 1, see Chapter 12), no systematic taphonomic data have been presented for the large mammal subassemblage since Leakey's (1971) monograph (see Fernández-Jalvo *et al*., 1998 for a discussion of small mammals). Therefore, and despite the fact that both cut marks and tooth marks have been identified in the large mammal subassemblage (Potts and Shipman, 1981; Shipman, 1983, 1986), the roles of hominids and carnivores in site formation are poorly understood. Although Shipman (1986) identified three cut-marked bovid specimens, this expanded analysis identified only one specimen preserving definitive cut marks and little to no evidence for hominid bonebreaking activities. Therefore, like the other large mammal subassemblages from the FLK North site, Level 5 can securely be attributed almost solely to the activities of carnivores.

Keywords: taphonomy | Olduvai | Plio-Pleistocene | bone surface modifications | zooanthropology

Chapter:

Introduction

The assemblage from Level 5 of the FLK North locality is particularly interesting because unlike many Bed I sites (except FLK North North Level 1, see Chapter 12), no systematic taphonomic data have been presented for the large mammal subassemblage since Leakey's (1971) monograph (see Fernández-Jalvo *et al*., 1998 for a discussion of small mammals). Therefore, and despite the fact that both cut marks and tooth marks have been identified in the large mammal subassemblage (Potts and Shipman, 1981; Shipman, 1983, 1986), the roles of hominids and carnivores in site formation are poorly understood. Although Shipman (1986) identified three cut-marked bovid specimens, this expanded analysis identified only one specimen preserving definitive cut marks and little to no evidence for hominid bone-breaking activities. Therefore, like the other large mammal subassemblages from the FLK North site, Level 5 can securely be attributed almost solely to the activities of carnivores.

The FLK North 5 Faunal Assemblage

SITE DISTURBANCE AND INTEGRITY

A predominance of fragments preserving less than half the original diaphyseal circumference (Type 1) indicate that the assemblage is unbiased by selective retention (Marean *et al*., 2004) (Figure 113). Figure 114 shows that fragments < 4 cm are slightly less well-represented than expected based on comparisons with experimental assemblages (Blumenschine, 1995; Pickering and Egeland, 2006). Only three specimens (0.2% of total NISP) exhibit the polishing indicative of extensive water transport. Compared to other sites such as DK (see Chapter 15), FLK North 5, along with the other assemblages in the FLK North sequence (see Chapters 7–9), experienced relatively low levels of postdepositional disturbance.

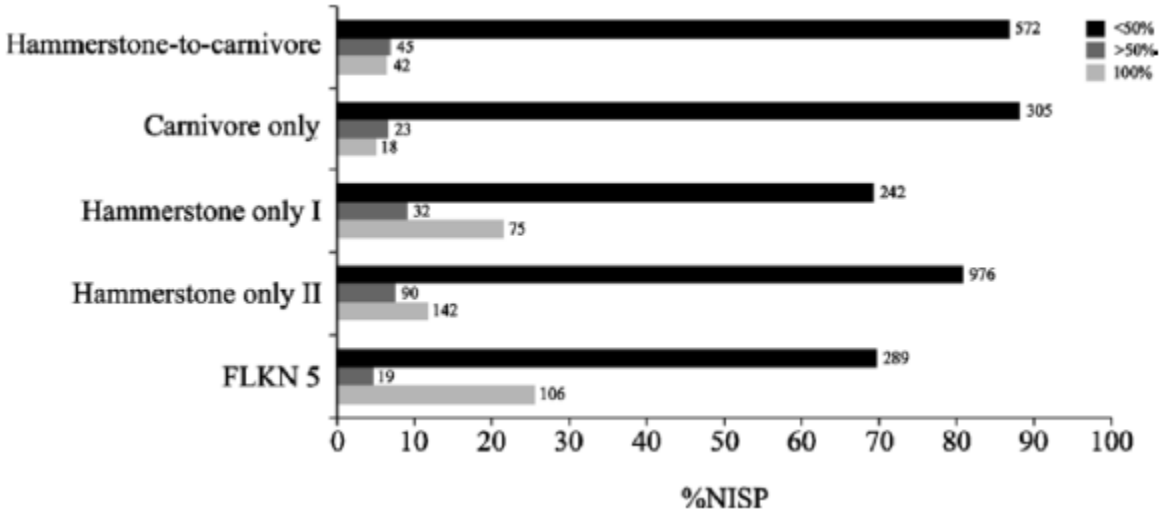

Figure 113. The percentage of Bunn's (1982) limb bone circumference types in the FLK North 5 assemblage compared to several experimental samples. Carnivore only, hammerstone-to-carnivore,and hammerstone only I samples from Marean *et al*. (2004). Hammerstone only II sample from Pickering and Egeland (2006).

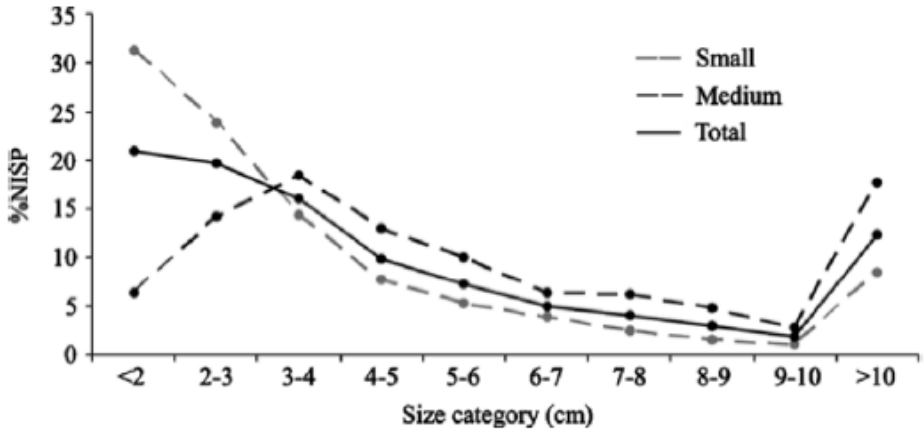

Figure 114. Percentage of specimens in each size range category at FLK North 5. Data are divided into specimens from small carcasses, medium carcasses, and combined.

TAXONOMIC AND SKELETAL REPRESENTATION

Table 47 summarizes the relative abundance of major faunal groups at FLK North 5. Bovids and carnivores are particularly well represented in the assemblage. Table 48 provides minimum number of individuals (MNI) estimates. Like the levels below it, the FLK North 5 fauna is dominated by *Antidorcas recki* and *Parmularius altidens*, perhaps suggesting a specialized bone-collecting agent.

Patterns of skeletal element representation also suggest that the bovids experienced a different taphonomic history than the suid subassemblage, which is dominated by teeth (Table 49). Relative to the number of individuals, skulls and limb bones are the most well-represented skeletal elements for both small (Size Class 1 and 2) and medium (Size Class 3a and 3b) carcasses, whereas axial bones are poorly represented (Table 50). According to Marean and Spencer's (1991) limb bone portions, midshafts provide the highest minimum number of element (MNE) estimate for all small-sized limb bones and for all but the metapodials for medium-sized carcasses (Table 51).

Table 47. Number of identified specimens (NISP) for major faunal groups at FLK North 5

Faunal group	NISP	%
Bovidae	909	76.2
Suidae	81	6.8
Equidae	1	0.1
Carnivora	202	16.9

Table 48. Minimum number of individuals (MNI) represented at FLK North 5

Taxon	MNI
A. recki	18
P. altidens	5
Beatragus sp.	1
Size 1 Neotragini	1
Size 3b Tragelapini	2
Size 3b Alcelaphini	3
Size 3 Hippotragini	1
Prototocyon recki	1
Kolpochoerus limnetes	2

Table 49. Number of identified specimens (NISP) by skeletal element for bovids and suids at FLK North 5

Element	Bovidae	Suidae
Cranium	40	2
Teeth	165	49
Mandible	22	5
Vertebrae	19	2
Ribs	10	3
Innominate	23	–
Scapula	15	3
Humerus	21	2
Radio-ulna	51	2
Carpals/tarsals	127	–
Metacarpal	42	–
Femur	32	–
Tibia	57	–

Element	Bovidae	Suidae
Metatarsal	61	–
Patella	5	–
Phalangers	145	13
Sesamoids	54	–
Metapodial	18	–
Limb bone shaft	2	–

Table 50. Minimum number of element (MNE) estimates for small (Size Class 1 and 2) and medium (Size Class 3) carcasses at FLK North 5

Element	Small	Medium	Total
Cranium	19	7	26
Mandible	16	7	23
Vertebrae	14	18	32
Innominate	17	4	21
Ribs	5	8	13
Scapula	13	3	16
Humerus	13	14	27
Radius	19	10	29
Ulna	9	9	18
Carpals	33	17	50
Metacarpal	17	13	30
Femur	10	12	22
Patella	6	2	8
Tibia	23	17	40
Tarsals	47	28	75
Metatarsal	20	16	36
Phalanges	119	18	137
Sesamoids	35	20	55

Table 51. Minimum number of element (MNE) estimates for limb bones by bone portion for small (Size Class 1 and 2) and medium (Size Class 3) carcasses at FLK North 5

Element	Small	Medium	Total
Humerus			
PR	2	0	2
PRS	3	2	5
SH	11	14	25
DSS	12	8	20
DS	12	5	17
Radius			
PR	12	5	17
PRS	12	7	19
SH	16	10	26
DSS	8	4	12
DS	3	3	6
Metacarpal			
PR	14	12	26
PRS	12	8	20
SH	16	12	28
DSS	12	7	19
DS	6	7	13
Femur			
PR	5	3	8
PRS	1	2	3

Element	Small	Medium	Total
SH	8	11	19
DSS	7	9	16
DS	7	5	12
Tibia			
PR	4	4	8
PRS	7	14	21
SH	19	15	34
DSS	10	12	22
DS	10	8	18
Metatarsal			
PR	17	12	29
PRS	16	13	29
SH	20	12	32
DSS	18	7	25
DS	13	5	18

Abbreviations: PR, proximal; PRS, proximal shaft; SH, midshaft; DSS, distal shaft; DS, distal

BONE SURFACE MODIFICATIONS

As in many of the Bed I assemblages, cortical surface preservation at FLK North 5 is good. Of those specimens scored for surface preservation, only 30.8% were considered to possess poorly preserved cortices, indicating that over two thirds of the assemblage is conducive to secure surface-mark identification. Only a single specimen, a cut-marked humerus from a Size Class 3a bovid, was found to preserve definitive hominid surface modifications. Therefore, Table 52 summarizes the raw incidence of tooth marks in the FLK North 5 assemblage. Tooth marks concentrate on limb bones and forelimbs in particular. The limb bones from small carcasses are tooth-marked at higher frequencies than medium carcasses.

Table 52. Tooth-mark frequencies for small (Size Class 1 and 2) and medium (Size Class 3) carcasses at FLK North 5

Element	Small	Medium	Total
Mandible	0/24 (0.0)	0/8 (0.0)	0/32 (0.0)
Vertebrae	3/16 (18.8)	1/27 (3.7)	4/43 (9.3)
Innominate	4/25 (16.0)	3/7 (42.9)	7/32 (21.9)
Ribs	3/23 (13.0)	1/22 (4.5)	4/43 (9.3)
Scapula	2/14 (14.3)	0/12 (0.0)	2/26 (7.7)
Humerus	7/16 (43.8)	2/28 (7.1)	9/44 (20.5)
Radius	8/26 (30.8)	1/21 (4.8)	9/47 (19.1)
Ulna	5/10 (50.0)	2/13 (15.4)	7/23 (30.4)
Carpals	0/33 (0.0)	0/17 (0.0)	0/50 (0.0)
Metacarpal	14/24 (58.3)	3/19 (15.8)	17/43 (39.5)
Femur	4/23 (17.4)	9/30 (30.0)	13/53 (24.5)
Patella	0/6 (0.0)	0/2 (0.0)	0/8 (0.0)
Tibia	11/36 (30.6)	6/57 (10.5)	17/92 (18.5)
Tarsals	2/49 (4.1)	1/28 (3.6)	3/77 (3.9)
Metatarsal	10/38 (26.3)	4/22 (18.2)	14/60 (23.3)
Phalanges	0/127 (0.0)	1/21 (4.8)	1/148 (0.7)
Sesamoids	0/35 (0.0)	0*30 (0.0)	0/55 (0.0)
Limb bone shaft	2/68 (2.9)	9/81 (11.1)	11/149 (7.4)
Total	75/593 (12.6)	43/435 (9.9)	118/1,028 (11.5)

Numerator denotes number of marked specimens; denominator denotes total NISP for each skeletal element; percentage is in parentheses

Given the lack of hominid surface modifications, one would expect tooth-mark frequencies on limb bone midshaft fragments (following Blumenschine's [1988, 1995] bone segment system) to mirror experimental "carnivore-only" scenarios where carnivores enjoyed sole access to flesh and marrow. However, as Figure 115 illustrates midshaft tooth-mark frequencies on small and medium carcasses fall outside the range of variation for these experiments and, for medium carcasses at least, match more closely "hammerstone-to-carnivore" experiments where hyenas ravaged defleshed and demarrowed bones. In the absence of hominid surface modifications and a lack of any other evidence for hominid bone-breaking (see later), it is unlikely, as the midshaft tooth-mark frequencies would initially suggest, that carnivores were ravaging hominid food refuse. However, if felids are considered a primary agent of bone modification at FLK North 5, which seems likely given the evidence presented for Levels 1–4 (see Chapters 8 and 9), the tooth-mark data make more sense. Felids are known to tooth mark limb bones and midshafts in particular at lower frequencies (Selvaggio, 1994; Domínguez-Rodrigo *et al*., in press) than the hyenas used in previous experimental studies (Blumenschine and Marean, 1993; Blumenchine, 1995; Capaldo, 1997, 1998b) (see Figure 115).

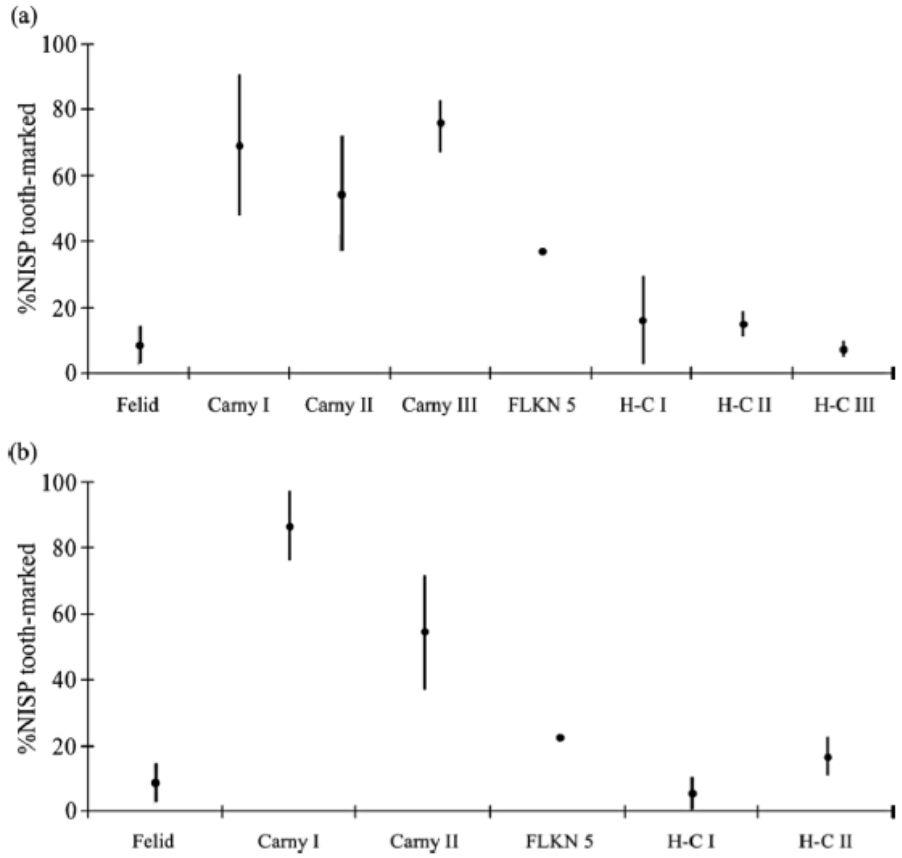

Figure 115. Incidence of tooth-marked midshaft fragments at FLK North 5 for (A) small-sized carcasses and (B) medium-sized carcasses compared to the mean and 95% confidence intervals for actualistic control assemblages. Only fossil specimens with green breakage and good cortical surface preservation are considered. *Abbreviations*: Felid, felid-consumed carcasses; Carny, carnivore-only; H-C, hammerstone-to-carnivore. (Data sources: Blumenschine [1995]; Capaldo [1997, 1998a, 1998b]; Marean *et al*. [2000]; Domínguez-Rodrigo *et al*. [in press].) *Note*: The range of variation from Marean's experiments ("Carny III" and "H-C III") are somewhat smaller because confidence intervals were calculated by bootstrapping a single sample (Marean *et al*., 2000: Table 3).

Tooth-mark frequencies on epiphyseal and near-epiphyseal fragments at FLK North 5 fall outside the 64–100% range observed in hyena-ravaged assemblages (Blumenschine, 1995; Capaldo, 1997, 1998b) (Table 53). They are also different from frequencies generated by leopards and cheetahs, which tooth mark these portions at rates of 15.9% and 16.8%, respectively (Domínguez-Rodrigo *et al*., in press). The fact that tooth-mark frequencies do not match exactly with any of the published actualistic control samples indicates that FLK North 5 represents a complex palimpsest in which: (1) some felid-modified carcasses were subsequently ravaged by hyenas; (2) some felid-modified carcasses were not ravaged; and (3) some carcasses represent natural deaths that were not processed by carnivores at all.

Table 53. Percentage of epiphyseal, near-epiphyseal, and midshaft specimens bearing tooth marks at FLK North 5

	EP	NEP	MSH	Total
Small carcasses				
NISP	21	8	52	81
NISP TM	13	2	19	34
%	61.9	25.0	36.5	42.0
Medium carcasses				
NISP	5	18	36	59
NISP TM	1	9	8	18
%	20.0	50.0	22.2	30.5

NISP counts include only those specimens with green breakage and good cortical surface preservation
Abbreviations: EP, epiphyseal; NEP, near-epiphyseal; MSH, midshaft

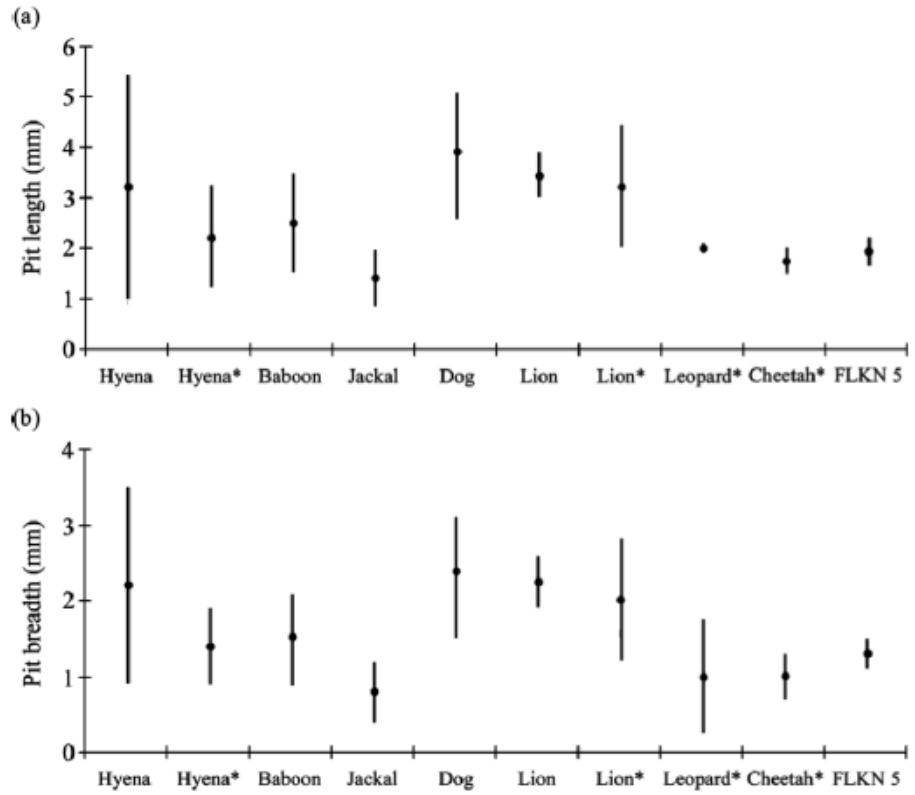

Figure 116. Mean and 95% confidence intervals for tooth pit (A) lengths and (B) breadths on the limb bone diaphyses of small-sized carcasses at FLK North 5 compared to actualistic samples. (Data indicated with an asterisk (*) are from Selvaggio [1994]; all other modern carnivore data are from Domínguez-Rodrigo and Piqueras [2003].)

Figure 116 summarizes tooth pit dimensions on small carcasses in the FLK North 5 assemblage. It seems likely that smaller carnivores with less robust dentitions, such as cheetahs and leopards, modified many of the small carcasses at FLK North 5. This is consistent with data presented for the lower levels of FLK North (Chapters 8 and 9) and contrasts with DK, where both small- and medium-sized carcasses were modified by larger carnivores such as lions and hyenas (see Chapter 15). The few tooth pits on medium carcasses (n = 3) at FLK North 5 match better with those created by larger carnivores.

BONE BREAKAGE

Unlike other levels from the FLK North site, FLK North 5 shows relatively high levels of diagenetic breakage, especially for medium carcasses (Figure 117). Complete bones make up a significant proportion of the limb bone MNE (Table 54), and it appears that they were being broken in direct proportion to their nutritional content. The relative proportions of Bunn's (1982) circumference types are similar to Levels 1 and 2 of the FLK North sequence (see Chapter 8) and differ from experimental assemblages with intensive hyena ravaging (Figure 113). The epiphysis-to-shaft fragment ratios for small (0.38) and medium (0.26) carcasses are higher than carnivore-only assemblages where ravaging is very intense (Blumenschine and Marean, 1993; Capaldo, 1998b). These data all suggest a relatively low level of ravaging in the FLK North 5 assemblage.

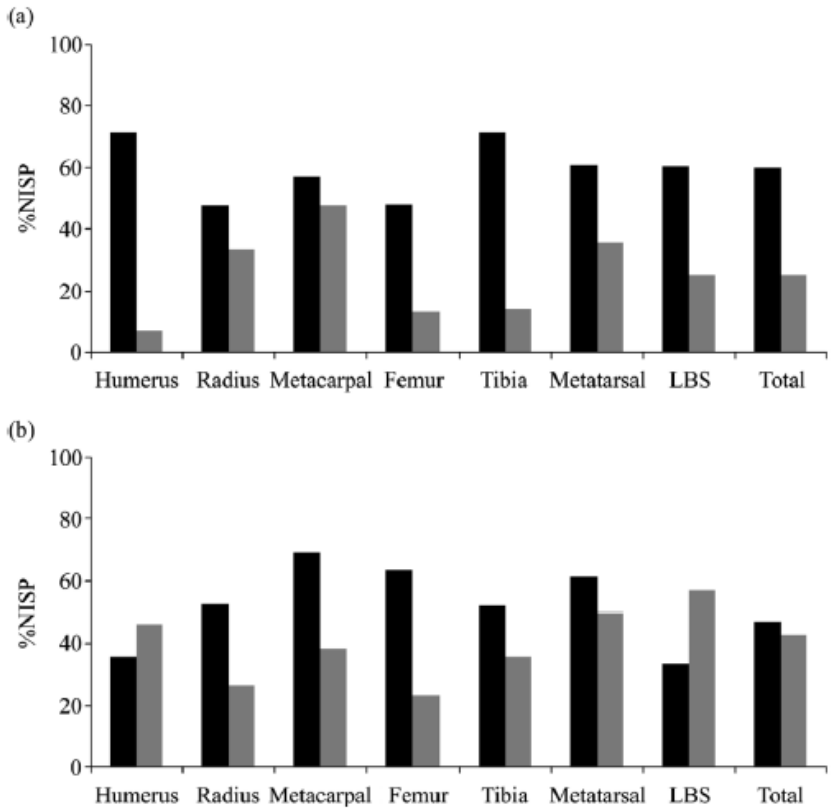

Figure 117. Incidence of green and diagenetic breakage on limb bones from (A) small and (B) medium carcasses at FLK North 5. Percentages may not add to 100% as specimens with recent breakage are not considered. *Abbreviations*: LBS, unidentified limb bone shaft.

Table 54. Frequencies of complete limb bones for small (Size Class 1 and 2) and medium (Size Class 3) carcasses at FLK North 5

Element	Small	Medium	Total
Humerus	2/13 (15.4)	0/14 (0.0)	2/27 (7.4)
Radius	2/19 (10.5)	1/10 (10.0)	3/29 (10.3)
Metacarpal	3/17 (17.6)	6/13 (46.2)	9/30 (30.0)
Femur	0/10 (0.0)	0/12 (0.0)	0/22 (0.0)
Tibia	1/23 (4.3)	1/17 (5.9)	2/40 (5.0)
Metatarsal	10/20 (50.0)	4/16 (25.0)	14/36 (38.9)
Total	18/102 (17.6)	12/82 (14.6)	30/184 (16.3)

Numerator denotes number of complete bones; denominator denotes total MNE for each limb bone; percentage is in parentheses

Fracture plane analysis can provide information on the identity of the bone-breaking agent. Although fracture planes from small carcasses overlap with both static (carnivore) and dynamic (hammerstone) experiments (Figure 118), fracture planes from medium-sized carcasses are more consistent with carnivore breakage (Figure 119).

Although only four notches were complete enough to calculate notch breadth:notch depth and scar breadth:notch depth ratios, all fall comfortably within the carnivore range (not pictured). Micronotches, which are characteristic of carnivore-broken assemblages, predominate in FLK North 5 and Incomplete Type C notches, also common in carnivore-broken assemblages, are abundant among medium-sized carcasses (Figure 120).

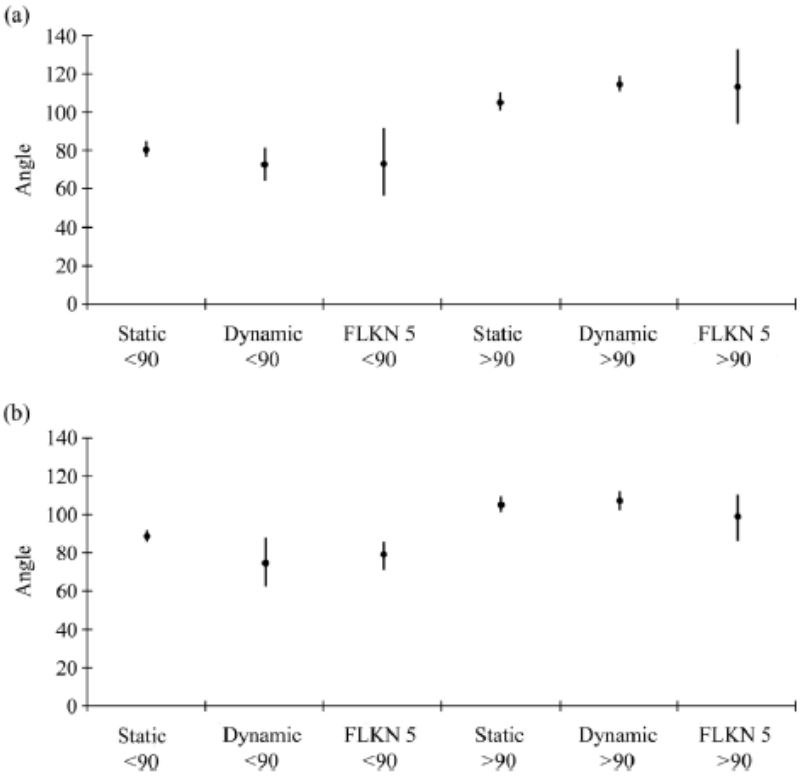

Figure 118. Mean and 95% confidence intervals of fracture angles from (A) oblique and (B) longitudinal planes on small-sized carcasses at FLK North 5 compared to experimental samples.

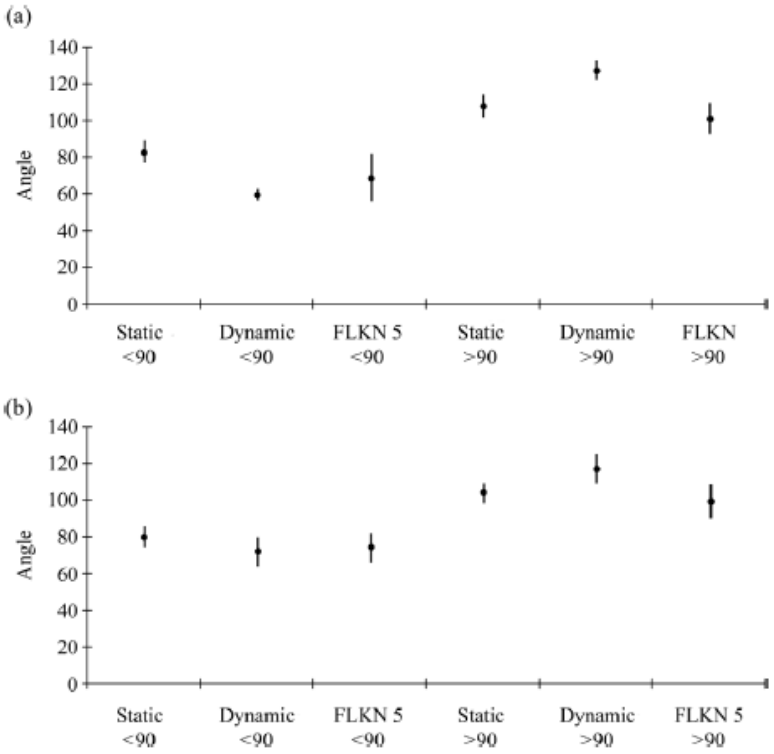

Figure 119. Mean and 95% confidence intervals of fracture angles from (A) oblique and (B) longitudinal planes on medium-sized carcasses at FLK North 5 compared to experimental samples.

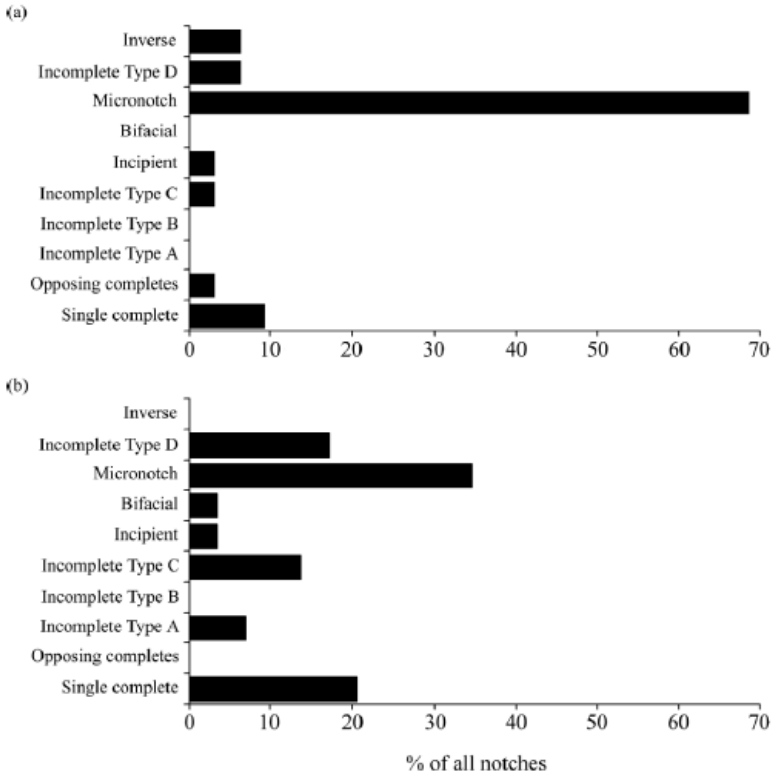

Figure 120. Incidence of notch types (modified from Capaldo and Blumenschine, 1994) from (A) small and (B) medium carcasses in the FLK North 5 assemblage.

Discussion and Conclusions

The bone assemblage from FLK North 5 is almost exclusively the result of carnivore activities. The lack of cut marks fits well with the fact that only ten flakes (presumably the main butchering tool of the Oldowan toolkit) occur in the 132-piece lithic assemblage (de la Torre, 2006). Although anvils and lithic pieces with percussion damage are present in the FLK North 5 assemblage (Leakey, 1971; de la Torre, 2006), the absence of percussion marks on bones and any evidence for hominid bone breakage suggests that these tools were used for a purpose other than carcass butchery.

A vast majority of the assemblage derives from just two bovid size classes from two species, *A. recki* (Size Class 1) and *P. altidens* (Size Class 3a). The low diversity of size classes and species strongly suggests some sort of specialized bone collector. A felid is the most likely agent here given the low overall incidence of tooth marks in the FLK North 5 assemblage. Tooth pit dimensions on small carcasses point to a medium-sized felid, and, given their propensity for specializing on two or three different prey species (Scott, 1987; Cavallo, 1998), leopards are a likely candidate. The modification of medium carcasses may be attributable to the larger bodied felid *Dinofelis*, which appears similar in its strategy of carcass acquisition and processing to leopards (Lewis, 1997).

As noted earlier, a number of factors suggest that the overall intensity of carnivore ravaging at FLK North 5 is low to moderate. The fact that limb bones were broken in proportion to their nutritional content indicates that carnivores were only processing higher yield elements for within-bone nutrients. This suggests further that when carcasses where discovered and processed, group size and/or levels of competition were low. Moreover, the large number of accumulated carcasses coupled with the fact that almost 1.5 ft of Level 5 deposit overlie the similarly thick deposits of Levels 1–4, all of which display high MNIs and felid taphonomic signatures, demonstrates that this area was favorable to felid carcass transport over a long period of time. It is therefore likely that trees were abundant in the vicinity, although within the broader context of a relatively open habitat, as FLK North 5 plots with Levels 1–2 in Domínguez-Rodrigo and Organista's ravaging stage 2 (see Chapter 11). This is in contrast to DK (Chapter 15) or levels from the FLK North North sequence (Chapters 12–14), which seem to indicate mixed and closed environments, respectively. The FLK North area would have provided hominids ample opportunities to passively scavenge from felid kills. The fact that little to no evidence for hominid carcass exploitation has been documented in these assemblages, including Level 5, indicates that this was not a commonly employed carcass acquisition strategy.

In order to understand the trophic dynamics that created the accumulations of carcasses described in this and previous chapters, it is necessary to know what the background bone scatters were like at Olduvai (some of which were addressed in Chapter 7), and how these scatters compare with the modern savanna ecosystems used as analogs for understanding Plio-Pleistocene savanna environments. Chapter 11 will provide new data on background bone scatters at Olduvai during Bed I times, and will show that studies of trophic dynamics and competition in modern savannas can be applied to interpret the paleoecological situation in the

Bed I sites, and therefore to understand the reasons why bones appeared more concentrated in some spots than in others.

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